.S

Introduction to software development tools

make

.h

.c++

.c

Michael Opdenacker

Free Electrons

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michael@free-electrons.com

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Source management

Program build automation

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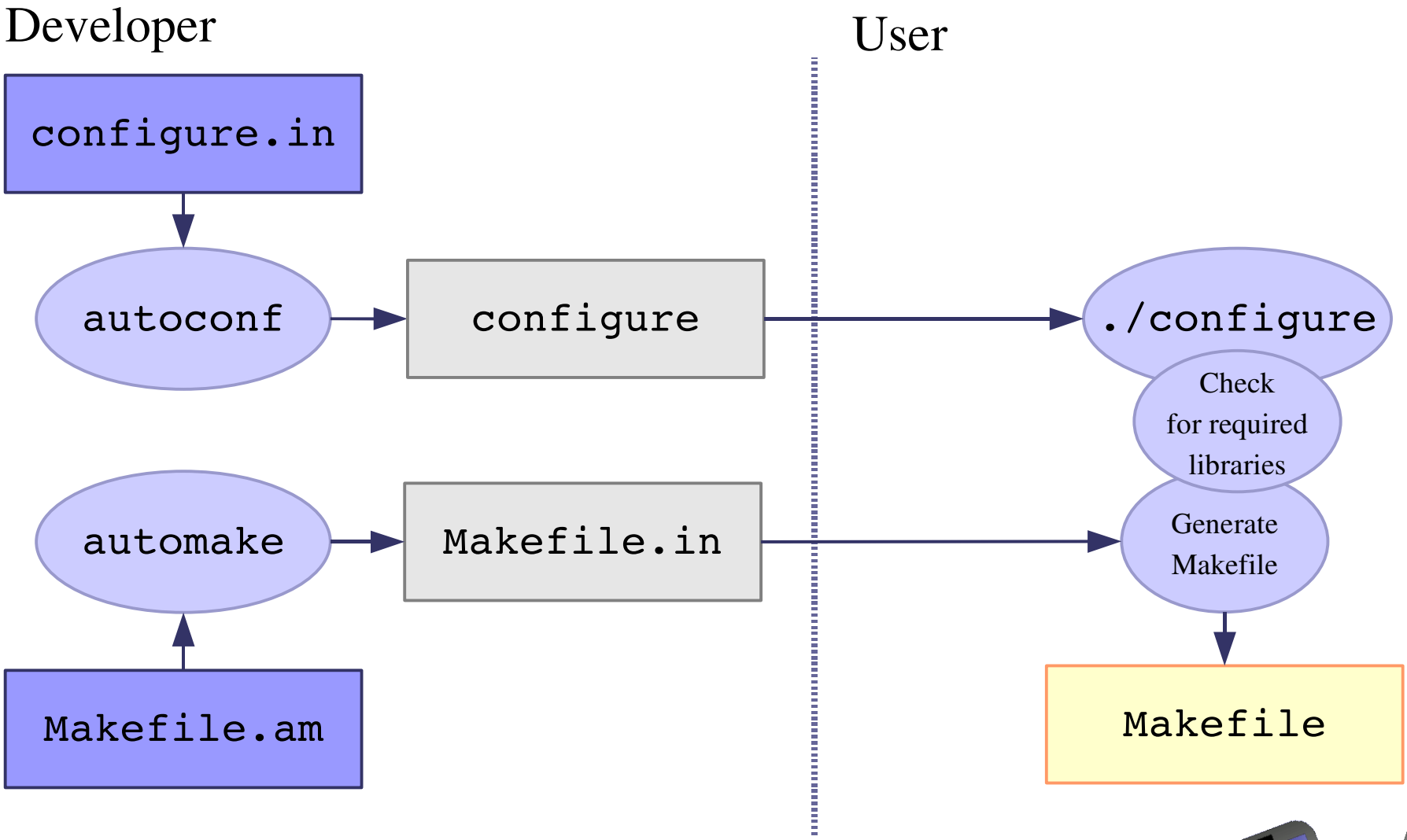
GNU toolchain flow (simplified)



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GNU toolchain strengths and weaknesses

Universal solution for Unix systems

- Still used to build most Free Software C and C++ programs, in particular in GNU
- Very powerful and easy for end users:

```
./configure --prefix=/opt
make
make check
make install
```

- Causes of check failures on the user side sometimes not easy to figure out.
- No standard configure options
- Output very complex Makefiles

Difficult for developers to master

- Lots of details to learn and understand
- Tedious documentation
- Multiple input and output files
- Causes of check failures on the user side sometimes not very easy to figure out.

See http://freshmeat.net/articles/view/889/, http://freshmeat.net/articles/view/1702/ and http://freshmeat.net/articles/view/1715/ for discussions about the limitations of autoconf / automake / make and alternatives.

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SCons (1)

http://www.scons.org/

- An alternative to `make`, written in Python
  A successor of the `Cons` program, written in Perl.
- Takes care of all the compiling and dependency handling job.
  Dependencies handled with MD5 checksums by default.
  Running `touch` on source files will have no effect!
- Also supports `autoconf` like capabilities: checking for existing libraries, headers or programs on the user system.
- Unlike `make`, `autoconf`, `automake`, no specific format!
  Access to all Python syntax and scripting facilities.

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SCons (2)

- Native support for lots of compiler based languages:
  C, C++, D, Java, Fortran, Yacc, Lex, Qt and SWIG, TeX and LaTeX
  Easily extensible through user-defined builders.
- Supports building on multiple platforms:
  GNU/Linux, Unix, Windows NT, MacOS X, OS/2
- Built-in support for fetching source files from SCCS, RCS, CVS, BitKeeper and Perforce.
- ... and many more features!

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SCons (3)

- Simple `SConstruct` file:

```
Library('foo', ['f1.c', 'f2.c', 'f3.c'])
Program('prog.c', LIBS=['foo', 'bar'], LIBPATH='.')
```

- Nice and friendly user manual full of examples:
  http://www.scons.org/doc/HTML/scons-user/book1.html

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Embedded Linux development tools

Source management

Static code checkers

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Splint

http://splint.org/, from the University of Virginia

- GPL tool for statically checking C programs for security vulnerabilities and coding mistakes
- Today's `lint` program for GNU/Linux.
  The successor of LClint.
- Very complete manual and documentation
- Doesn't support C++

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Debugging and analysis tools

Memory checkers

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GNU Checker

http://gnu.org/software/checker/

GNU GPL tool to find memory errors at runtime

- Detects: reading uninitialized memory, writing in a freed zone, accesses outside of allocated memory, and using NULL pointers.
- Garbage collector: can display all memory leaks
- Works by replacing glibc's malloc library by its own
- Usage:

```
checkergcc -o example example.c
```

- Supports only: Intel GNU/Linux, Sparc Sun Solaris
- Latest release in 1998!

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memcheck

http://hald.dnsalias.net/projects/memcheck/

- GNU GPL tool for dynamic memory checking
- Works by replacing glibc's memory management functions by its own.
- Supports many GNU/Linux and other Unix architectures (unlike GNU Checker): `i386`, `arm`, `alpha`, `ia64`. Many others not tested.

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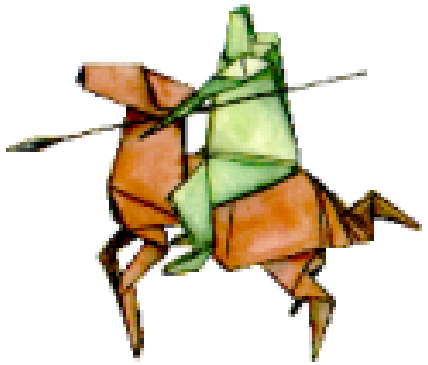
Valgrind (1)

http://valgrind.org/



- GNU GPL Software suite for debugging and profiling programs.
- Supported platforms: `x86`, `x86_64`, `ppc`
  Others: compile your program to these platforms to use Valgrind.
- Can detect many memory management and threading bugs.
- Profiler: provides information helpful to speed up your program and reduce its memory usage.
- The most popular tool for this usage.
  Even used by projects with hundreds of programmers

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Valgrind (2)

- Can be used to run any program, without the need to recompile it.
- Example usage
```
valgrind --leak-check=yes ls -la
```
- Works by adding its own instrumentation to your code and then running in on its own virtual x86 core. Significantly slows down execution, but still fine for testing!
- More details on http://valgrind.org/info/ and http://valgrind.org/docs/manual/coregrind_core.html#howworks

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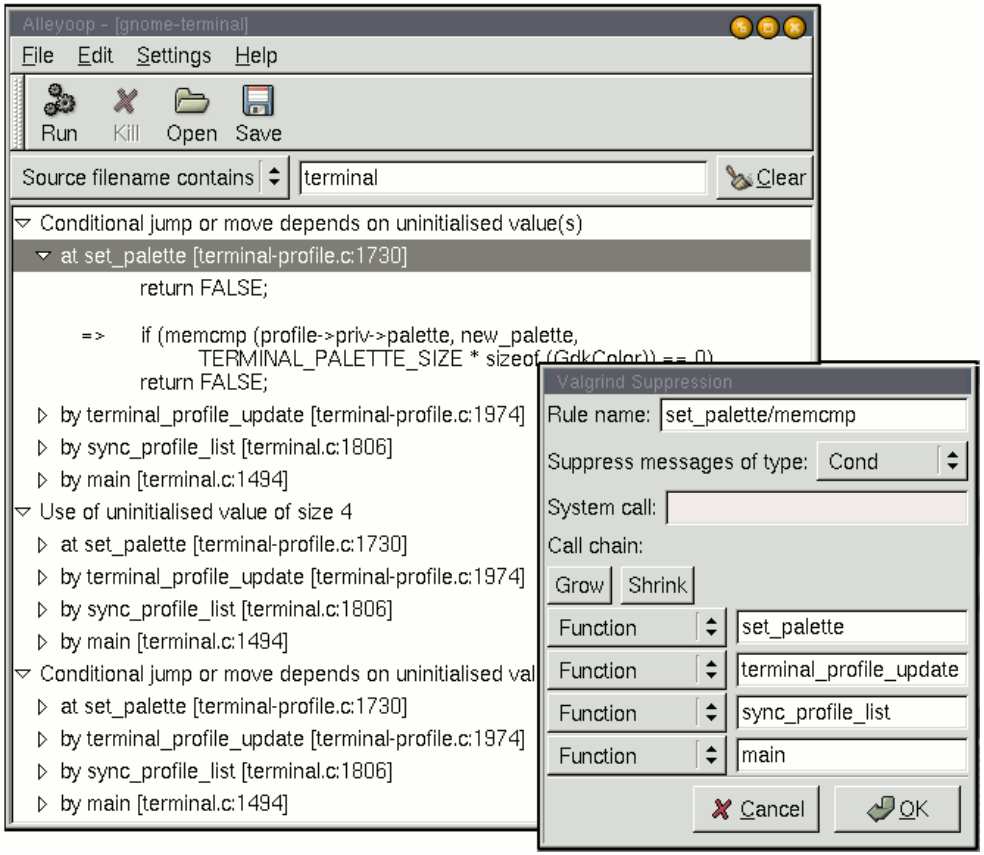
Alleyoop

http://alleyoop.sourceforge.net/

Graphical front-end to Valgrind



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ElectricFence

`efence`, GNU GPL, from Bruce Perens
http://directory.fsf.org/devel/debug/ElectricFence.html

- Stops your program on the exact instruction that overruns or underruns a `malloc()` memory buffer.
- GDB will then display the source-code line that causes the bug.
- Works by using the virtual-memory hardware to create a red-zone at the border of each buffer - touch that, and your program stops.
- Supposed to work on any platform supported by Linux, whatever the cpu (provided virtual memory support is available)

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